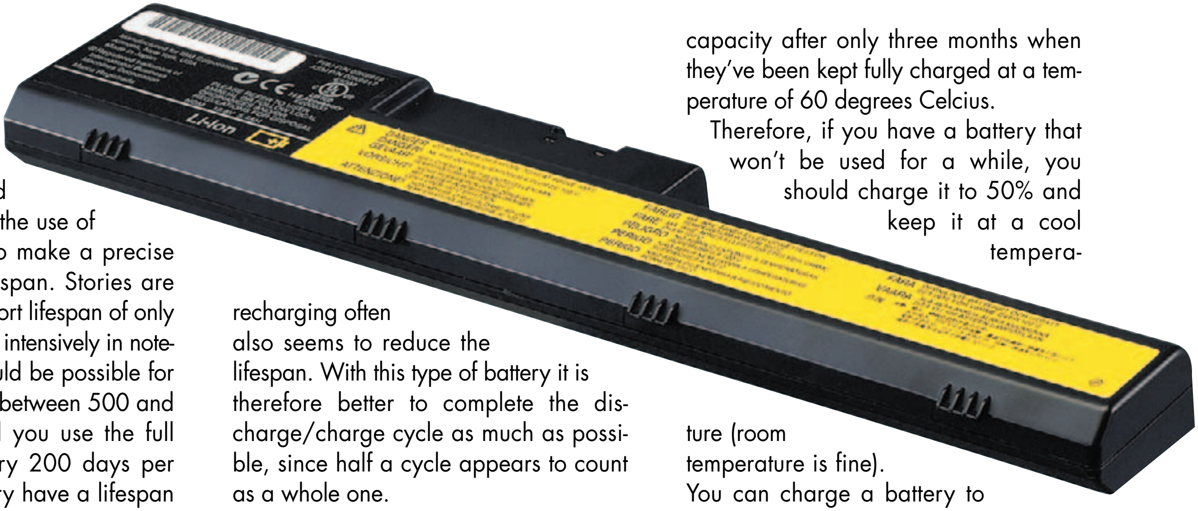
Lifespan of Li-Ion Batteries

Karel Walraven



New technologies can introduce new problems. We haven't really had enough experience in the use of Lithium-Ion batteries to make a precise statement on their lifespan. Stories are floating around of a short lifespan of only a few years when used intensively in notebooks, whereas it should be possible for them to last anywhere between 500 and 1,000 cycles. Should you use the full capacity of the battery 200 days per year, it should in theory have a lifespan of about three years. But even when the battery has gone through only 100 cycles it appears to have lost some capacity.

With nickel-cadmium and nickel-hydride cells it is recommended that they are never fully discharged, nor fully charged. The NiMH battery used by Toyota in the 'Prius' car operates between 40 % and 80 % of capacity and has an 8-year guarantee. If it was used between 0 and 100 % it wouldn't even survive one year of intensive use.

Lithium-Ion batteries appear to behave differently. Discharging by 20 % and recharging often also seems to reduce the lifespan. With this type of battery it is therefore better to complete the discharge/charge cycle as much as possible, since half a cycle appears to count as a whole one.

A second aspect is the oxidation of the electrodes. They begin to deteriorate right from the moment of manufacture and that process is unavoidable. This causes a gradual reduction in the useable capacity. Although this process can't be stopped, it can be slowed down. The key words here are 'low temperature' and 'not fully charged'. It is ironic that this is the exact opposite to the conditions found in a typical notebook: the battery is kept fully charged and the temperature is often around 40 degrees Celcius. There have been reports of batteries losing half their capacity after only three months when they've been kept fully charged at a temperature of 60 degrees Celcius.

Therefore, if you have a battery that won't be used for a while, you should charge it to 50% and keep it at a cool temperature (room temperature is fine).

You can charge a battery to 50 % of its capacity by reducing the charging voltage to about 3.9 V. In any case, you should check the output voltage of the charger and take away a few tenths of a volt. Accidents can happen when the charging voltage is too high!

Another cause of failure is when the battery is deeply discharged due to self-discharge. To avoid damage the battery voltage should never drop below 2 V. At room temperature this means that the battery should be checked once or twice a year, and recharged if necessary.

(044023-1)